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(54) NEEDLE RETRACTION MECHANISMS

VORRICHTUNGEN ZUM ZURÜCKZIEHEN VON NADELN

MECANISMES DE RAPPEL D'AIGUILLE

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(73) Proprietor: **NMT Group PLC**
Bellshill, Lanarkshire ML4 3NJ (GB)

(72) Inventor:
McMAHON, Keith, Herd, Younie
Rosyth Fife KY11 2RQ (GB)

(74) Representative:
McNeight, David Leslie
McNeight & Lawrence
Regent House
Heaton Lane
Stockport Cheshire SK4 1BS (GB)

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Description

The invention is concerned with improvements in or relating to retraction mechanisms for use in fluid handling devices, said mechanisms being arranged to bring about the retraction of a hollow needle into a housing after use. Such devices are used in many facets of the medical field, for the administration of drugs or a drip feed into a blood vessel, or for drawing off liquid samples, for example, blood from patients.

It will be understood that there is a wide range of fluid handling devices incorporating needles in use in the field of medicine for the administration of drugs and the like for blood sampling, including use in procuring more than one sample from a patient over a period of time.

It is important that the needles of such devices, which are frequently intended for disposal after a single use, are rendered inoperative to prevent accidental injury or re-use with the substantial risk of cross-contamination.

Syringes provided with guards of one kind or another which are automatically deployed to shield the needle after use are known, as are syringes where the needle is automatically retracted after use into the body of the device.

The invention provides a fluid handling device having a needle retraction assembly adapted to bring about the retraction of a hollow needle after use comprising a hollow body portion provided at one end thereof with an end wall having a mounting portion including a needle passage, and a hollow needle having a mounting means and adapted to be movable between a first position in which a leading end portion of the needle protrudes from a front end portion of said mounting portion and a second position in which the needle is withdrawn within the hollow body portion, said mounting means including resilient means that act to bias the needle into the second, withdrawn, position, said needle being provided with an enlarged portion at a location spaced from the leading end portion thereof, there being provided retaining means to maintain the needle in its first position until use is completed, said retaining means comprising in combination an O-ring positioned in a circumferential groove in said enlarged portion and abutting the end of a sleeve which can be forced forwardly to dislodge the O-ring so as to permit the needle to move from its first position into its second position under the influence of said resilient means.

The sleeve may be restrained from rearward movement when the needle is in its first position by a shoulder which abuts a flange at the forward end of the body portion.

The resilient means may be a compression spring located between a forward reaction surface provided by the mounting portion and a rearward reaction surface provided by the forward end of the enlarged portion.

When the needle is in its first position the O-ring may be compressed between the enlarged portion and the mounting portion, which provides a relieved part at its forward end to receive the O-ring when it is dislodged.

The fluid handling device may be a syringe, there being a piston which may be depressed to travel through the body portion to discharge liquid therefrom through the needle, the piston being in the form of a tube having closed ends, the forward of which is provided with a closure member which is separable from the end by engagement with the sleeve as the piston is fully depressed to provide an aperture in the end through which the needle may pass to enter the interior of the piston as it assumes its second position.

The mounting portion may be off-centre and towards a peripheral edge of the body portion.

The cross-sections of the body portion and piston may be such as to prohibit incorrect assembly having regard to the position of the closure member.

The cross-sections of the body portion and piston may be such that whilst permitting assembly in more than one rotational position relative to one another, proper operation is assured, there being more than one closure member in the end of the piston.

The body portion and piston may be of elliptical section, there being two spaced closure members in the end of the piston.

The hollow body portion may not be intended to receive a piston, and a piston-like tool may be inserted into the body portion to cause retraction of the needle into the tool when desired.

The sleeve may be located in a recess accessible by a portion of reduced size on the forward end of the tool adapted to enter the recess to engage with the sleeve. This prevents premature retraction of the needle.

US 4 966 593 discloses a syringe with a needle retraction mechanism wherein the needle is locked prior to retraction by a collet arrangement comprising special parts which require manufacture to close tolerances.

There will now be described two examples of device according to the invention. It will be understood that the description which is to be read with reference to the drawings is given by way of example only and not by way of limitation.

In the drawings :-

Figure 1	is a side view of a syringe according to the invention, in an unused condition;
Figure 2	is a longitudinal section of the syringe taken on line II-II of Figure 1 and to an enlarged scale;
Figure 3	is an end view of the syringe;
Figure 4	is a section on lines IV -IV of Fig-

ure 2;

Figure 5 is an opposite end view, being a needle end view;

Figure 6 is a sectional view similar to Figure 1 illustrating an intermediate stage in the depression of a plunger of the syringe;

Figure 7 is a similar view illustrating the completion of the depression step;

Figures 8, 9 and 10 are fragmentary views to an enlarged scale of portions of Figures 2, 6 and 7 respectively;

Figure 11 is a fragmentary longitudinal sectional view of a fluid handling device for taking blood samples;

Figure 12 is a similar view with a needle retraction tool inserted therein; and

Figure 13 is a view of the device with the needle thereof in a retracted condition.

A disposable syringe 2 is shown in Figure 1 comprising a hollow body portion 4, from the rear of which (upper end as viewed in Figure 1) protrudes a piston 6. At the lower end of the body portion 4 is provided a mounting portion 8 for a needle 10, having a through passage at the inner end of which is an upstanding annular wall 9 (Figures 8-10).

The hollow body portion 4, which is non-opaque, is graduated in millilitres for convenience and is provided with finger-engaging flanges 12 in the conventional manner. The body portion 4 has a slightly outwardly flared end portion 15. The mounting portion 8 is secured to an end wall 14 of the body portion 4 in an off-centre position at 16 (see Figure 2) to facilitate use of the syringe in enabling the needle 10 to penetrate tissue or a blood vessel at as shallow an angle as desired.

The inner end of the needle 10 connects with a collar 18 having an annular groove 19 in which is received an O-ring 20. The collar 18 is bonded to the needle so as to be integral therewith.

As best seen from Figures 3 to 5 the body portion 4 and piston 6 are of elliptical section which avoids any tendency for unwanted relative rotation of the parts.

The mounting portion 8 provides a passageway for the needle 10 and provides a first reaction surface 26 for a compression spring 28 surrounding the needle. A second reaction surface 30 is provided on a forward end of the collar 18. When assembled the spring 28 is in an almost fully compressed condition between the surfaces 26 and 30 and is maintained in that condition by engagement of the O-ring 20, which is compressed between an annular wall portion 32 of the mounting part 8 and its groove 19, with an end surface 34 of a sleeve 36 surrounding the collar 18 and comprising at its rearward end an extension 38, formed by lugs, which project into the hollow body portion 4 in the pre-use condition shown in Figures 2 and 8.

As may be seen in Figure 8, an annular space 35 is provided to the forward side of O-ring 20.

The sleeve 36 has a shoulder 37 which engages an annular flange 39 at the forward end of the body 4 to prevent rearward movement of the sleeve 36 from its initial position shown in Figures 2 and 8.

The piston 6 is hollow having its rear end closed by means of a cap 40. It will be noticed that the diameter of the piston is greatest at the rear end of the piston at 13, that is, adjacent the end cap 40 and tapers inwardly towards the body portion.

The other end of the piston is arranged to receive a closure member 42 which engages firmly in the piston to form an end wall having two areas 44 defined by lines of weakness 46 so as to be readily removed on contact with the sleeve extension lugs 38 in a manner to be explained below. The provision of two such areas 44 obviates the need to check the position of the off-set needle 10 during assembly.

In operation, the syringe is conveniently charged with liquid in a normal manner, to achieve its ready-for-use condition in which the piston 6 is received within the body portion 4 by a short distance as shown in Figure 2. The closure member 42 of the piston thus also acts as a seal for the liquid contents of the body portion.

On actuation of the piston 6 so as to move forwardly (or downwardly as viewed in the Figure 1), the advance of the end wall of the member 42 expels the liquid through the needle 10. Figure 9 shows the position of the parts immediately before the expulsion of the liquid is completed. It will be observed that the end wall of the member 42 has contacted the lugs 38 of the sleeve member 36 and has forced the member 36 forwardly as shown in Figure 9. However, liquid may still pass from the body portion 6 to the needle 10 due to the spaces between the lugs 38 of the member 36. In Figure 10, the movement of the sleeve member 36, because of its contact with the O-ring 20 that is received in the groove 19, has caused the collar 18 also to move forwardly, further compressing the spring 28 to a fully compressed state. In addition, this movement causes the O-ring 20 to be released from entrapment in the groove 19 by the annular portion 32 and to be dislodged to enter the annular space 35, where it is received over the wall 9 of the mounting portion 8. Thus the restraint acting upon the needle end portion 18 is removed. The fully compressed spring 28 is now no longer constrained and extends rapidly, propelling the needle end portion 18 and therefore also the needle itself rearwardly. The

sleeve member 36 and its lugs 38 are together of such a length as still to project into the hollow interior of the body portion 4. The lugs therefore provide a pressure area against the area 44 so as to shear the line of weakness 46. The needle 10 is thus free to pass through the sleeve member 36 into the hollow interior of the piston 6, so that the needle is withdrawn from access by potential re-users of the syringe. It will be understood that the piston 6 cannot in practice readily be withdrawn from the body portion 4 to facilitate access to the needle, since the annular portion 13 of the piston 6 is firmly wedged into the flared end portion 15 of the body portion 4 and thus resists removal.

The syringe may therefore now be disposed of without risk to persons subsequently handling the needle.

Figure 11 shows a fragmentary view of a needle retraction mechanism indicated at 48, for use in a device for taking repeated blood samples. The device comprises an open-ended housing 50 into which is inserted an evacuated tube 52 of the kind sold under the Registered Trade Mark "Vacutainer", having a diaphragm 54 which is pierced by a rear end portion 56 of a double-ended hollow needle 58 so that the sample may be drawn into the tube 52. Conveniently, the needle 58 may remain in place during the period of time in which it may be necessary to take a series of samples, but when the series is completed, the needle must be removed and the risks associated with used needles then arise.

The needle retraction mechanism of the device of Figures 11 to 13 is similar in many respects to that shown in the syringe of Figures 1 to 10, like parts being indicated by like reference numerals.

The needle 58 which as mentioned above is double-ended and passes through the collar 18.

A recessed portion 82 is formed in forward wall of the housing 50 which has a surface 86 against which the evacuated tube 52 abuts in normal use. Thus in normal use, it will be observed, no contact is made by the tube 52 with the lugs 38.

Figure 12 illustrates the means by which the needle 58 may be retracted out of an operative condition and into a position which it cannot be used again nor can it injure anyone handling it.

Thus when the final sample has been taken and the needle of the device needs to be removed from the patient's arm, a tool 88 is inserted into the housing 50 as shown in Figure 12. The tool 88 comprises plunger-like hollow body portion 90 and an annular projection or neck 92 that is surrounded by a shoulder surface 94. The neck 92 has a circular opening 96. As the tool 88 is inserted into the housing 50, the needle end portion 56 enters the opening 96 in the neck 92 and the neck itself enters the recess 82 in the housing 50. The leading edge surface of the neck 92 contacts the lugs 38 and continued pressure applied to move the tool forwardly as shown in Figure 12 causes the sleeve member 36 to move forwardly to dislodge the O-ring 20 to release the needle 58 for discharge into the body of the tool 88. A snap-on ring clip 98 around the tool 88 ensures that the tool is not accidentally removed from the housing 50 before safe disposal.

Various modifications may be made within the scope of the invention as defined by the following claims.

Claims

1. A fluid handling device having a needle retraction assembly adapted to bring about the retraction of a hollow needle after use comprising a hollow body portion (4) provided at one end thereof with an end wall (14) having a mounting portion (8) including a needle passage, and a hollow needle (10) having a mounting means and adapted to be movable between a first position in which a leading end portion of the needle protrudes from a front end portion of said mounting portion and a second position in which the needle is withdrawn within the hollow body portion, said mounting means including resilient means (28) that act to bias the needle into the second, withdrawn, position, said needle being provided with an enlarged portion (18) at a location spaced from the leading end portion thereof, there being provided retaining means to maintain the needle in its first position until use is completed, characterised in that said retaining means comprises in combination an O-ring (20) positioned in a circumferential groove (19) in said enlarged portion and abutting the end of a sleeve (36) which can be forced forwardly to dislodge the O-ring so as to permit the needle to move from its first position into its second position under the influence of said resilient means.

2. A fluid handling device according to claim 1 wherein the sleeve is restrained from rearward movement when the needle is in its first position by a shoulder (37) which abuts a flange (39) at the forward end of the body portion.

3. A fluid handling device according to claim 1 or claim 2 wherein the resilient means is a compression spring located between a forward reaction surface (30) provided by the mounting portion and a rearward reaction surface (26) provided by the forward end of the enlarged portion.

4. A fluid handling device according to any one of claims 1 to 3 wherein when the needle is in its first position, the O-ring is compressed between the enlarged portion and the mounting portion, which provides a relieved part (35) at its forward end to receive the O-ring when it is dislodged.

5. A fluid handling device according to any preceding

claim being a syringe (2), there being a piston (6) which may be depressed to travel through the body portion to discharge liquid therefrom through the needle, the piston being in the form of a tube having closed ends, the forward of which is provided with a closure member (44) which is separable from the end by engagement with the sleeve as the piston is fully depressed to provide an aperture in the end through which the needle may pass to enter the interior of the piston as it assumes its second position.

6. A syringe according to claim 5 wherein the mounting portion is off-centre and towards a peripheral edge of the body portion.

7. A syringe according to claim 6 wherein the cross-sections of the body portion and piston are such as to prohibit incorrect assembly having regard to the position of the closure member.

8. A syringe according to claim 6 wherein the cross-sections of the body portion and piston are such that whilst permitting assembly in more than one rotational position relative to one another, proper operation is assured, there being more than one closure member in the end of the piston.

9. A syringe according to claim 8 wherein the body portion and piston is of elliptical section, there being two spaced closure members in the end of the piston.

10. A fluid handling device according to any one of claims 1 to 4 wherein the body portion is not intended to receive a piston, there being a piston-like tool (88) insertable into the body portion to cause retraction of the needle (56) into the tool when desired.

11. A fluid handling device according to claim 10 wherein the sleeve is located in a recess (82) accessible by a portion of reduced size (92) on the forward end of the tool adapted to enter the recess to engage with the sleeve.

Patentansprüche

1. Fluid-Handhabungsvorrichtung mit einer Anordnung zum Zurückziehen von Nadeln, die geeignet ist zum Durchführen des Zurückziehens einer hohlen Nadel nach Gebrauch, mit einem hohlen Körperbereich (4), der an einem seiner Enden mit einer Endwand (14) mit einem Befestigungsbereich (8) enthaltend einen Nadeldurchgang versehen ist, und mit einer hohlen Nadel (10) mit Befestigungsmitteln, welche geeignet ist, zwischen einer ersten Position, in welcher ein vorderer Endbereich der Nadel von einem vorderen Endbereich des Befestigungsbereichs vorsteht, und einer zweiten Position, in welcher die Nadel innerhalb des hohlen Körperbereichs zurückgezogen ist, bewegbar zu sein, wobei die Befestigungsmittel elastische Mittel (28) enthalten, die zur Voreinstellung der Nadel in die zweite zurückgezogene Position wirken, und die Nadel mit einem vergrößerten Bereich (18) an einer Stelle, die im Abstand von deren vorderem Endbereich angeordnet ist, versehen ist, wobei dort Zurückhaltemittel vorgesehen sind, um die Nadel in ihrer ersten Position zu halten, bis der Gebrauch beendet ist,
dadurch gekennzeichnet,
daß die Zurückhaltemittel in Kombination einen O-Ring (20) aufweisen, der sich in einer Umfangsnut (19) in dem vergrößerten Bereich befindet und an das Ende einer Manschette (36) anstößt, welche in Vorwärtsrichtung gezwungen werden kann, um den O-Ring so zu versetzen, daß der Nadel ermöglicht wird, sich unter dem Einfluß der elastischen Mittel aus der ersten Position in die zweite Position zu bewegen.

2. Fluid-Handhabungsvorrichtung nach Anspruch 1, worin, wenn die Nadel in ihrer ersten Position ist, die Manschette zurückgehalten wird von einer Rückwärtsbewegung durch eine Schulter (37), welche an einem Flansch (39) an dem vorderen Ende des Körperbereichs anstößt.

3. Fluid-Handhabungsvorrichtung nach Anspruch 1 oder Anspruch 2, worin die elastischen Mittel eine Druckfeder sind, die sich zwischen einer durch den Befestigungsbereich vorgesehenen vorderen Reaktionsfläche (30) und einer durch das vordere Ende des vergrößerten Bereichs vorgesehenen hinteren Reaktionsfläche (26) befindet.

4. Fluid-Handhabungsvorrichtung nach einem der Ansprüche 1 bis 3, worin, wenn die Nadel in ihrer ersten Position ist, der O-Ring zusammengedrückt ist zwischen dem vergrößerten Bereich und dem Befestigungsbereich, welcher einen ausgesparten Teil (35) an seinem vorderen Ende bildet zur Aufnahme des O-Ringes, wenn dieser versetzt ist.

5. Fluid-Handhabungsvorrichtung nach jedem der vorhergehenden Ansprüche, welche eine Spritze (2) ist, daß ein Kolben (6) vorgesehen ist, welcher herabgedrückt werden kann, um durch den Körperbereich hindurchzugehen für die Ausgabe von Fluid aus diesem durch die Nadel, wobei der Kolben die Form eines Rohres mit geschlossenen Enden hat, von denen das vordere mit einem Verschlußglied (44) versehen ist, welches von dem Ende trennbar ist durch Eingriff mit der Manschette, wenn der Kolben ganz herabgedrückt ist, um eine Öffnung in

dem Ende zu ergeben, durch welche die Nadel hindurchgehen kann, um in das Innere des Kolbens einzutreten, wenn sie ihre zweite Position annimmt.

6. Spritze nach Anspruch 5, worin der Befestigungsbereich außerhalb der Mitte und zu einer Umfangskante des Körperbereichs hin angeordnet ist.

7. Spritze nach Anspruch 6, worin die Querschnitte des Körperbereichs und des Kolbens derart sind, daß sie ein nicht korrektes Zusammensetzen mit Bezug auf die Position des Verschlußgliedes unterbinden.

8. Spritze nach Anspruch 6, worin die Querschnitte des Körperbereichs und des Kolbens derart sind, daß, während sie ein Zusammensetzen in mehr als einer Drehstellung relativ zueinander ermöglichen, ein ordnungsgemäßer Betrieb sichergestellt ist, wobei mehr als ein Verschlußglied in dem Ende des Kolbens vorgesehen ist.

9. Spritze nach Anspruch 8, worin der Körperbereich und der Kolben von elliptischem Querschnitt sind, wobei zwei im Abstand voneinander angeordnete Verschlußglieder in dem Ende des Kolbens vorgesehen sind.

10. Fluid-Handhabungsvorrichtung nach einem der Ansprüche 1 bis 4, worin der Körperbereich nicht zur Aufnahme eines Kolbens vorgesehen ist und ein kolbenartiges Werkzeug (88) vorhanden ist, das in den Körperbereich einführbar ist, um ein Zurückziehen der Nadel (56) in das Werkzeug zu bewirken, wenn dies erwünscht ist.

11. Fluid-Handhabungsvorrichtung nach Anspruch 10, worin sich die Manschette in einem Einschnitt (82) befindet, der durch einen Bereich (92) von reduzierter Größe an dem vorderen Ende des Werkzeugs, das für den Eingriff mit der Manschette zum Eintritt in den Einschnitt geeignet ist, zugänglich ist.

Revendications

1. Dispositif de manipulation de fluide ayant un ensemble de rétraction d'aiguille prévu pour effectuer la rétraction d'une aiguille creuse après utilisation, comportant une partie de corps creux (4) pourvue à une extrémité d'une paroi d'extrémité (14) ayant une partie de montage (8) comprenant un passage d'aiguille, et une aiguille creuse (10) ayant des moyens de montage et prévue pour être mobile entre une première position dans laquelle une partie d'extrémité avant de l'aiguille dépasse d'une partie d'extrémité avant de ladite partie de montage et une deuxième position dans laquelle l'aiguille est rétractée à l'intérieur de la partie de corps creux, lesdits moyens de montage comprenant des moyens élastiques (28) qui agissent afin de rappeler l'aiguille dans la deuxième position rétractée, ladite aiguille étant pourvue d'une partie agrandie (18) dans un emplacement espacé de la partie d'extrémité avant, des moyens de retenue étant prévus afin de maintenir l'aiguille dans sa première position jusqu'à ce que l'utilisation soit terminée, caractérisé en ce que lesdits moyens de retenue comprennent en combinaison un joint torique (20) positionné dans une rainure circonférentielle (19) dans ladite partie agrandie et butant contre l'extrémité d'un manchon (36) qui peut être forcé vers l'avant afin de déloger le joint torique de façon à permettre à l'aiguille de se déplacer depuis sa première position jusqu'à sa deuxième position sous l'influence desdits moyens élastiques.

2. Dispositif de manipulation de fluide selon la revendication 1, dans lequel le manchon est empêché de se déplacer vers l'arrière lorsque l'aiguille est dans sa première position par un épaulement (37) qui bute contre un rebord (39) au niveau de l'extrémité avant de la partie de corps.

3. Dispositif de manipulation de fluide selon la revendication 1 ou la revendication 2, dans lequel les moyens élastiques sont constitués par un ressort de compression disposé entre une surface de réaction avant (30) procurée par la partie de montage et une surface de réaction arrière (26) procurée par l'extrémité avant de la partie agrandie.

4. Dispositif de manipulation de fluide selon l'une quelconque des revendications 1 à 3, dans lequel, lorsque l'aiguille est dans sa première position, le joint torique est comprimé entre la partie agrandie et la partie de montage, qui procure une partie dégagée (35) à son extrémité avant afin de recevoir le joint torique lorsqu'il est délogé.

5. Dispositif de manipulation de fluide selon l'une quelconque des revendications précédentes, et qui est une seringue, avec un piston (6) qui peut être enfoncé afin de se déplacer à travers la partie de corps de façon à évacuer du liquide à travers l'aiguille, le piston étant sous la forme d'un tube ayant des extrémités fermées, dont l'avant est pourvu d'un élément de fermeture (44) qui est séparable de l'extrémité par engagement avec le manchon lorsque le piston est totalement enfoncé afin de procurer une ouverture dans l'extrémité à travers laquelle l'aiguille peut passer afin d'entrer à l'intérieur du piston lorsqu'elle prend sa deuxième position.

6. Seringue selon la revendication 5, dans laquelle la partie de montage est décentrée et vers un bord

périphérique de la partie de corps.

7. Seringue selon la revendication 6, dans laquelle les sections de la partie de corps et du piston sont telles qu'elles empêchent un assemblage incorrect en ce qui concerne la position de l'élément de fermeture.

8. Seringue selon la revendication 6, dans laquelle les sections de la partie de corps et du piston sont telles que, tout en permettant l'assemblage dans plus d'une position de rotation l'une par rapport à l'autre, un fonctionnement correct est assuré, dans la mesure où il y a plus d'un élément de fermeture dans l'extrémité du piston.

9. Seringue selon la revendication 8, dans laquelle la partie de corps et le piston sont d'une section elliptique, deux éléments de fermeture espacés se trouvant dans l'extrémité du piston.

10. Dispositif de manipulation de fluide selon l'une quelconque des revendications 1 à 4, dans lequel la partie de corps n'est pas prévue pour recevoir un piston, un outil en forme de piston (88) pouvant être inséré dans la partie de corps afin de provoquer la rétraction de l'aiguille (56) lorsque cela est souhaité étant prévu.

11. Dispositif de manipulation de fluide selon la revendication 10, dans lequel le manchon se trouve dans un renfoncement (82) accessible par une partie de taille réduite (92) sur l'extrémité avant de l'outil prévue pour entrer dans le renfoncement afin d'engager le manchon.

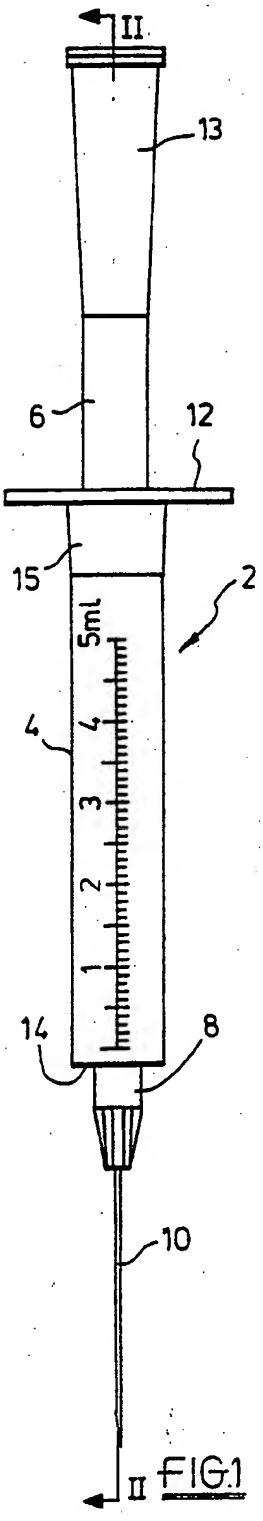

FIG.1

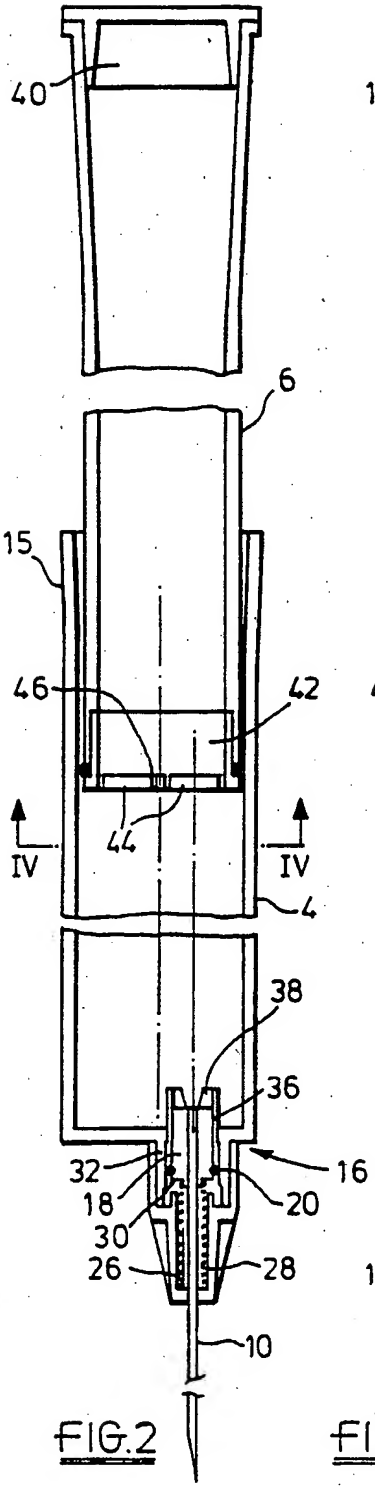

FIG.2

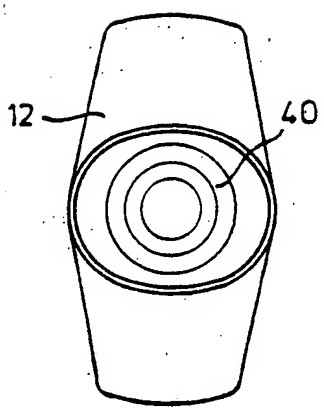

FIG.3

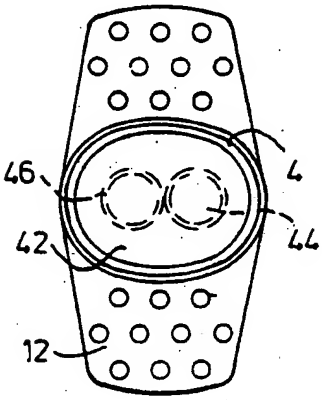

FIG.4

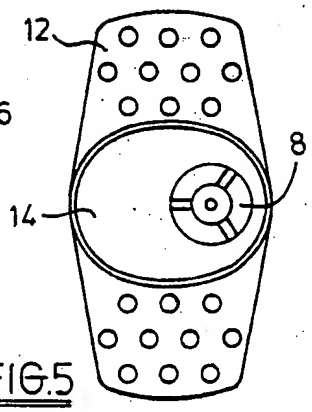

FIG.5

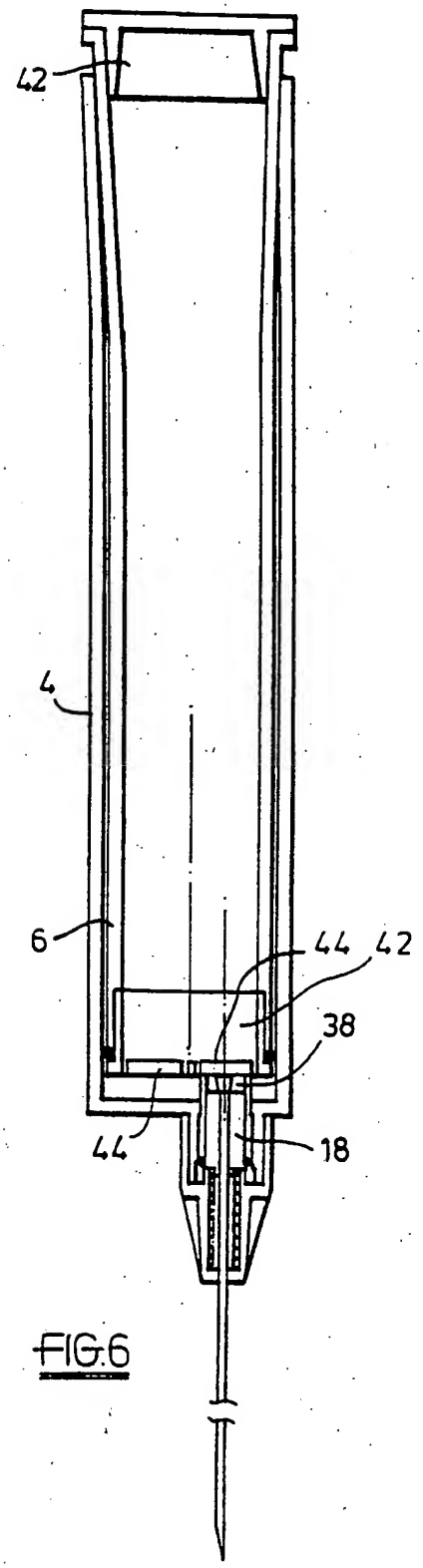

FIG.6

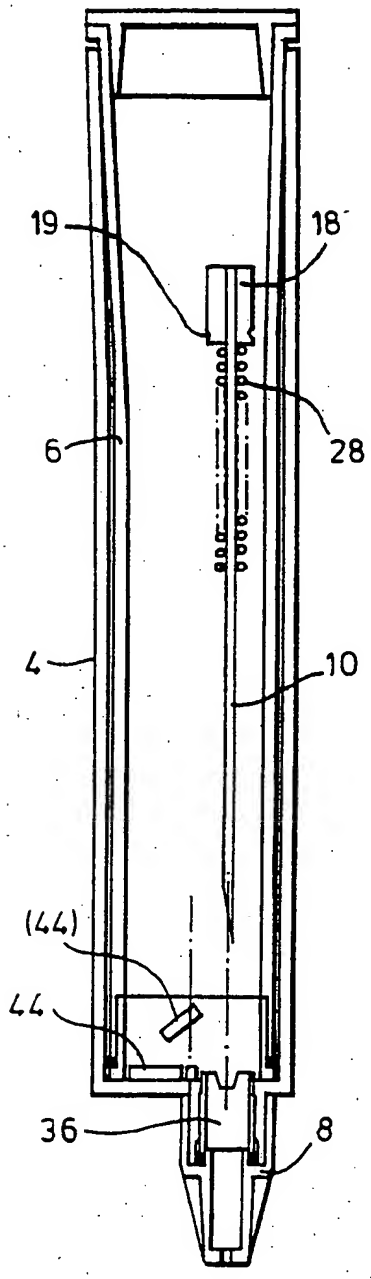

FIG.7

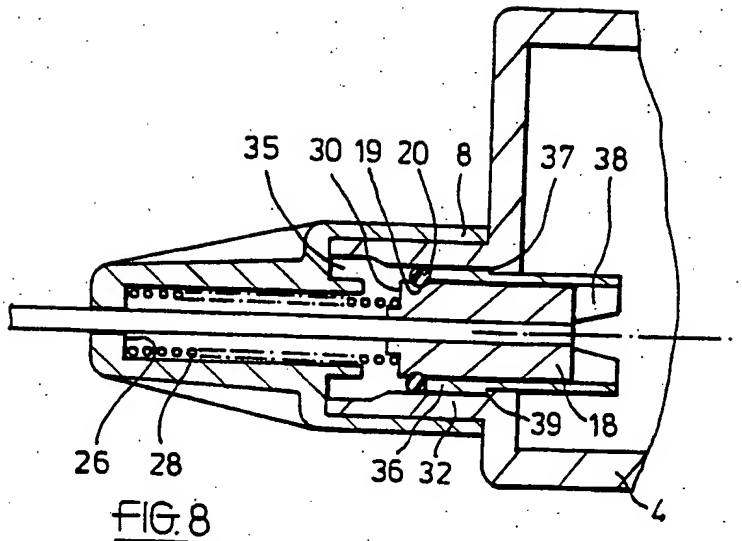

FIG.8

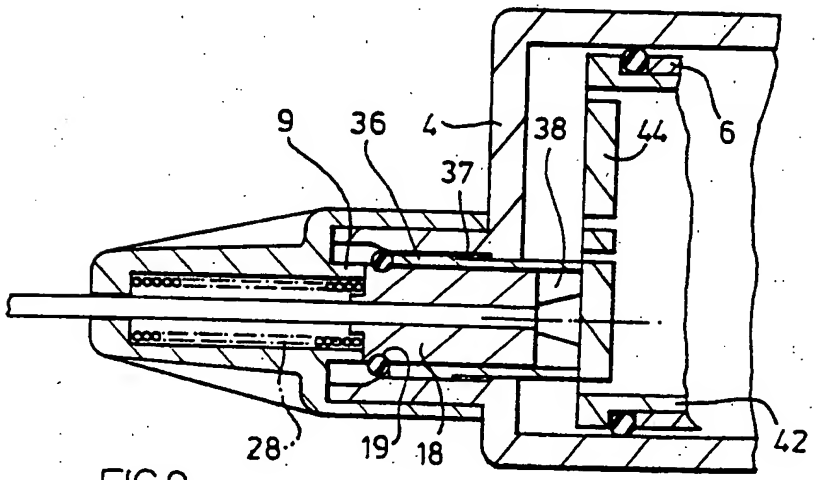

FIG.9

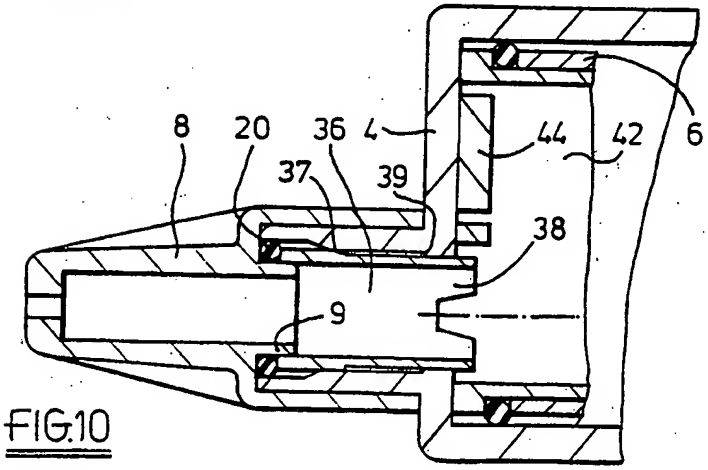

FIG.10

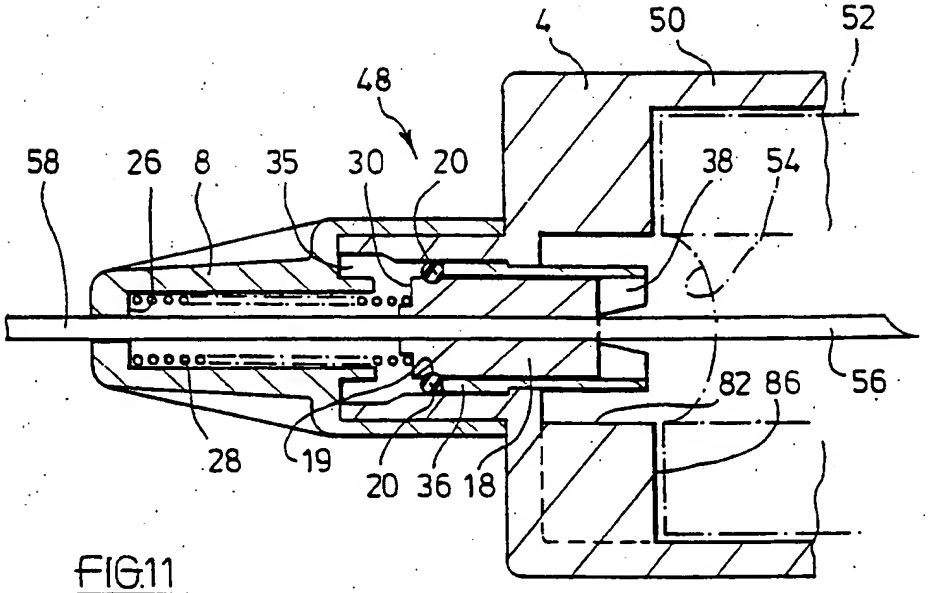
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FIG.11

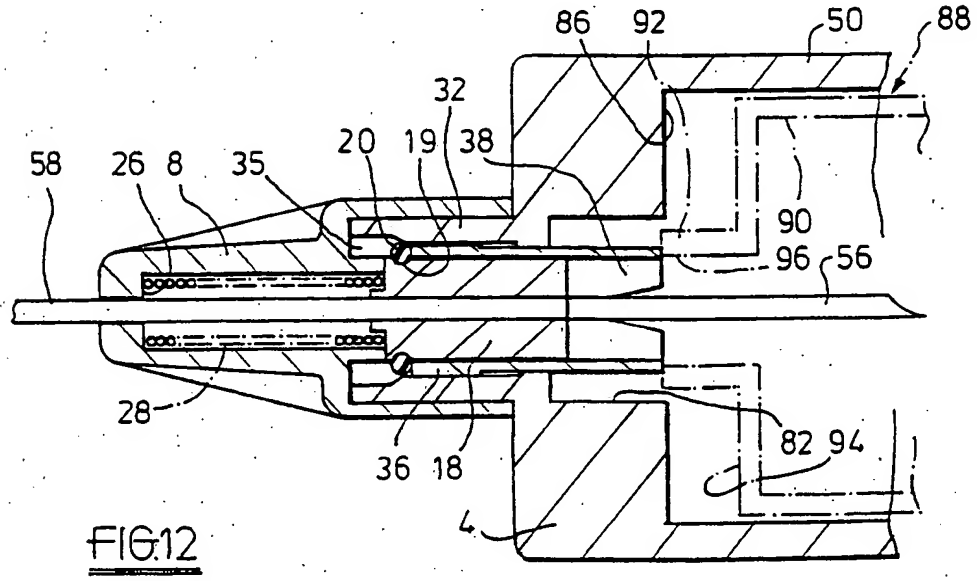
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FIG.12

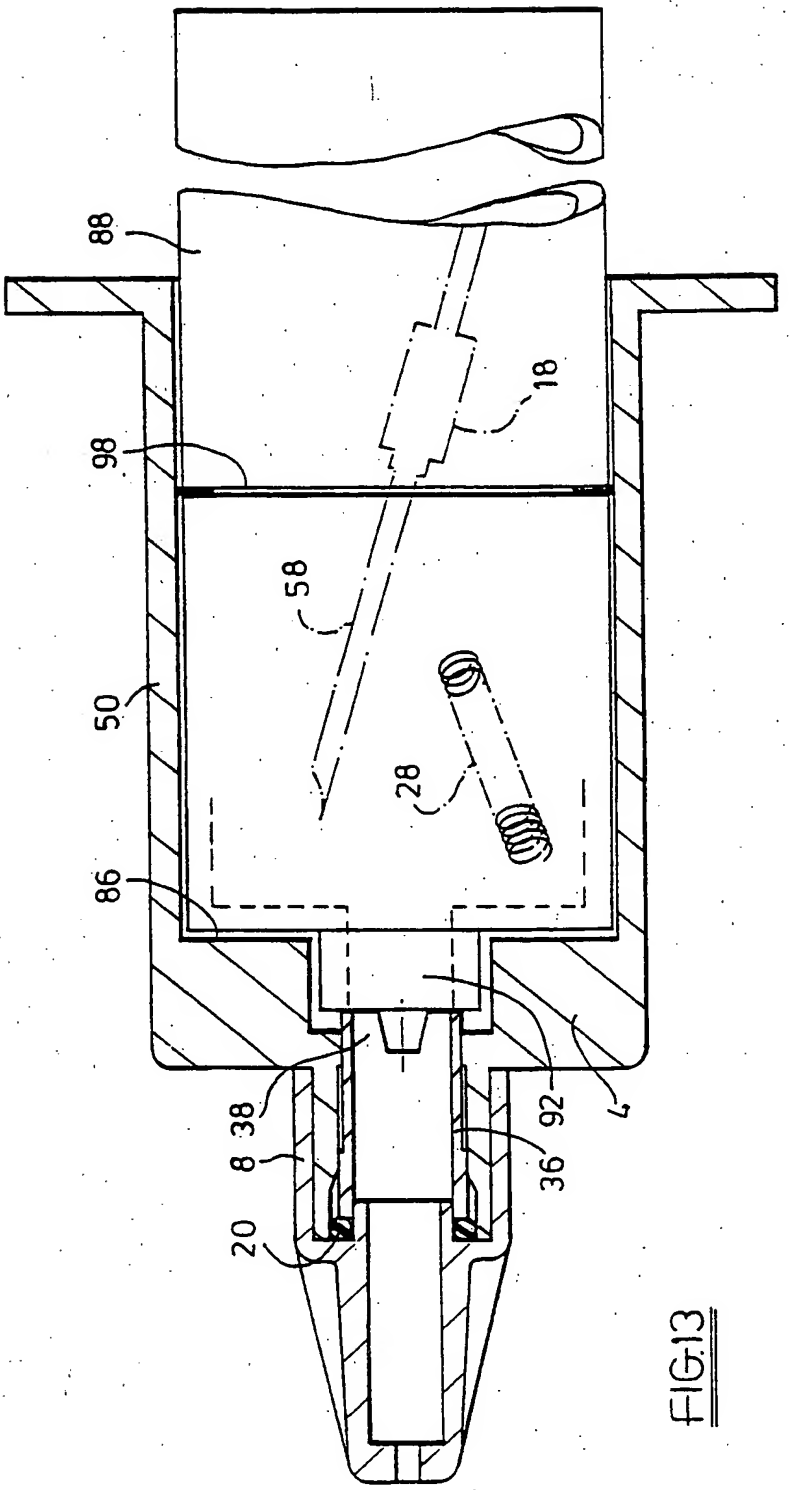

FIG.13